What is claimed is:

1. A method for forming a metallic overlay comprising:

supplying a metal substrate with a thermal expansion coefficient "**X**";

supplying a metal alloy which has a thermal expansion coefficient "**Y**", wherein **Y>X**;

melting said metal alloy and applying said metallic alloy to said metal substrate to form an alloy/substrate interface;

forming metallurgical bonds between said metallic alloy and said substrate at said alloy/substrate interface; and

causing said alloy to shrink while said alloy is constrained at said alloy/substrate interface thereby developing a residual compressive stress in said metallic alloy.

2. The method of claim 1 wherein said alloy is comprised of a mixture of Fe, Cr, Mo, W, B, C, Si and Mn.

3. The method of claim 2, wherein Fe is present at levels above 50.0 wt %.

4. The method of claim 2, wherein Fe, Cr, Mo, and W comprise at least 90 wt % of said mixture.

5. The method of claim 1 wherein Fe and Cr comprise at least 90 wt % of said mixture, and Cr is present at levels of about 1.0 wt. %, and Mo is present at levels of about 1.0 – 2.0 wt %.

6. The method of claim 1 wherein Fe and Cr comprise at least 90 wt. % of said mixture, and Cr is present at levels of about 1.0 wt. %, and Mo is present at levels of about 1.0 – 2.0 wt. %, and W is present at levels of about 3.0 – 4.0 wt %, B is present at levels of about 1.0 – 2.0 wt %, C is present at levels of about 0.1 – 1.0 wt %, Si is present at levels of 0.1 – 1.0 wt % and Mn is present at levels of 0.1 – 1.0 wt %.

7. The method according to claim 2 wherein said metallic alloy has a composition of about 65.9 wt % Fe, 25.3 wt % Cr, 1.0 wt % Mo, 1.8 wt % W, 3.5 wt % B, 1.2 wt % C, 0.5 wt % Si, 0.8 wt % Mn.

8. The method according to claim 2 wherein said metallic alloy has a composition of 64.9 wt % Fe, 26.0 wt % Cr, 1.0 wt % Mo, 1.4 wt % W, 3.6 wt % B, 1.2 wt % C, 1.0 wt % Si, 0.8 wt % Mn.

9. The method according to claim 1 wherein said metallic alloy has a composition of 68.0 wt % Fe, 23.2 wt % Cr, 1.2 wt % Mo, 1.5 wt % W, 3.6 wt % B, 0.9 wt % C, 0.7 wt % Si, 0.8 wt % Mn.

10. The method according to claim 1 wherein applying said metallic alloy comprises welding.

11. The method according to claim 1 wherein applying said metallic alloy comprises thermal spray coating.

12. The method according to claim 1 wherein said metallic alloy has a coefficient of thermal expansion greater than 15% of that of the base substrate.

13. The method according to claim 1 wherein said iron based metallic alloy has a coefficient of thermal expansion in the range of 12 to 17 ppm/°C.

14. A method for forming a metallic overlay comprising:

supplying a metal substrate with a thermal expansion coefficient "**X**";

supplying a metal alloy which has a thermal expansion coefficient "**Y**", wherein **Y>X** and wherein said metal alloy has a yield strength "**Z**";

melting said metal alloy and applying said metallic alloy to said metal substrate to form an alloy/substrate interface;

forming metallurgical bonds between said metallic alloy and said substrate at said alloy/substrate interface; and

causing said alloy to shrink while said alloy is constrained at said alloy/substrate interface thereby developing a residual compressive stress in said metallic alloy, wherein said compressive stress does not exceed the yield strength "**Z**".

15. The method of claim 14 wherein said compressive yield strength is greater than about 1520 MPa at room temperature.

16. A method for forming a metallic overlay comprising:

supplying a metal substrate with a thermal expansion coefficient "**X**";

supplying a metal alloy which has a thermal expansion coefficient "**Y**", wherein **Y>X** and wherein said metal alloy has a yield strength "**Z**";

melting said metal alloy and applying said metallic alloy to said metal substrate to form an alloy/substrate interface;

forming metallurgical bonds between said metallic alloy and said substrate at said alloy/substrate interface; and

causing said alloy to shrink while said alloy is constrained at said alloy/substrate interface thereby developing a residual compressive stress in said metallic alloy, wherein said compressive stress does not exceed the yield strength "**Z**" and wherein said metal alloy has a hardness of greater than about 850 kg/mm^2.

17. A method for forming a metallic overlay comprising:

supplying a metal substrate;

supplying a metal alloy;

melting said metal alloy and applying said metallic alloy to said metal substrate to form an alloy/substrate interface;

forming metallurgical bonds between said metallic alloy and said substrate at said alloy/substrate interface; and

causing said alloy to cool to provide said alloy with a fracture toughness greater than 200 MPa $m^{1/2}$ and a hardness greater than 5 GPa.